

# Image Acquisition in Real Time

In 1995, Carlos Jorquera left NASA's Jet Propulsion Laboratory (JPL) to focus on erasing the growing void between high-performance cameras and the requisite software to capture and process the resulting digital images. Since his departure from NASA, Jorquera's efforts have not only satisfied the private industry's cravings for faster, more flexible, and more favorable software applications, but have blossomed into a successful entrepreneurship that is making its mark with improvements in fields such as medicine, weather forecasting, and X-ray inspection.

Formerly a JPL engineer who constructed imaging systems for spacecraft and ground-based astronomy projects, Jorquera is the founder and president of the three-person firm, Boulder Imaging Inc., based in Louisville, Colorado. Joining Jorquera to round out the Boulder Imaging staff are Chief Operations Engineer Susan Downey, who also gained experience at JPL working on space-bound projects—including Galileo and the Hubble Space Telescope, and Vice President of Engineering and Machine Vision Specialist Jie Zhu Kulbida, who has extensive industrial and research and development experience within the private sector.

The Boulder Imaging team's vast engineering talent shines through on its flagship image capture and processing software product, *AcquireNow*. As a Component Object Model (COM) component, *AcquireNow* provides software developers with the programmatic tools necessary to create software applications that can acquire images from high data rate digital cameras and apply image-processing algorithms to those images (COM is a software architecture developed by Microsoft® that allows components made by different software vendors to be combined into a variety of applications). Essentially, *AcquireNow* users can obtain images from any camera, using any frame grabber board, without having to write any hardware-specific software.

The most important feature of *AcquireNow* is its ability to perform sustained image acquisition from high frame rate and/or high-resolution digital cameras. With the correct pairing of camera and frame grabber hardware, and a dual peripheral component interconnect bus system (an expansion slot for personal computers), the software can acquire image data at rates exceeding 500 megabytes per second. The technology also encompasses powerful image-processing algorithms, including averaging, flat fielding, scaling, edge detection, blob analysis, and display. Additionally, it uses multiple threads of execution to allow image processing to occur



Image courtesy of Advanced Imaging Technologies, Inc.

*AcquireNow* is the software imaging engine within the Avera™ Breast Imaging System.

in one thread, while an acquisition thread is waiting for a frame to come in from the camera. This multi-threaded option permits the software to take advantage of multiple computers, thus, increase performance on these systems.

The *AcquireNow* software package includes the *AcquireNowClient* stand-alone application, which can be used to obtain, display, and save images to disk. The source code for *AcquireNowClient* is also included, so that customers may freely use it as a base for internal or commercial applications.

In 2002, Advanced Imaging Technologies, Inc., of Preston, Washington, licensed *AcquireNow* and embedded it in its Avera™ Breast Imaging System, which permits rapid assessment of breast tissue in real time, without the discomfort of compression or the risk of harmful radiation. The Avera Breast Imaging System features Advanced Imaging Technologies' first commercial use of the company's patented Diffractive Ultrasound innovation, a unique imaging technology based on the principles of sound. Unlike conventional ultrasound that relies on sound's reflective properties, Diffractive Ultrasound takes advantage of the diffractive properties to collect high-resolution images from soft tissue structures, such as the breast. *AcquireNow* is responsible for capturing, processing, and depicting the images clearly on a computer screen.

*AcquireNow* has also been instrumental in the detection of ice crystals that form in high-altitude clouds. Boulder Imaging developed both the real-time processing system and the post-processing software for Boulder, Colorado-based Stratton Park Engineering Company (SPEC), Inc.'s Cloud Particle Imager, a device that takes high-resolution digital images of cloud



Boulder Imaging Inc., developed both the real-time processing system and the post-processing software for Stratton Park Engineering Company, Inc.'s Cloud Particle Imager (mounted on the underbelly of the Learjet).

Image courtesy of Stratton Park Engineering Company, Inc.

particles and flew aboard NASA's WB-57 aircraft during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers – Florida Area Cirrus Experiment (CRYSTAL-FACE) mission.

SPEC's Cloud Particle Imager is comprised of a high-speed camera that snaps extremely fast pictures of the particles inside of a cloud as the plane flies through it. *AcquireNow* is used to detect the edges of ice particles in real time, and determine what in an image is a particle and what is not. Sizing information for each ice particle identified in the images is computed, and statistical information is generated, tracking particle size distribution over time. Researchers can then use this data to study the microscopic factors that influence cloud physics, and ultimately, how clouds affect the atmosphere's temperature. The Cloud Particle Imager—also popular among international governments interested in cloud research related to global climate change—is just one of seven SPEC products to incorporate the *AcquireNow* technology.

*AcquireNow* is also making its presence known on manufacturing assembly lines, aiding in the quick detection of faulty circuit boards and other machine parts. Agilent Technologies, of Palo Alto, California, purchased *AcquireNow* for use in its 5DX quality control system, designed to detect structural defects through an X-ray source.

More recently, Boulder Imaging embarked on a project in which *AcquireNow* is being used to image the

conditions of highways. By linking the software with a global positioning system and a special camera that takes multiple shots of a road surface at 50 miles per hour, *AcquireNow* can portray images of the road structure that prove valuable to highway engineers.

The company notes that future applications for the software may be seen in airports to expedite and enhance baggage searches, in machine vision systems to read zip codes on mailing labels, and in the entertainment industry for digital data storage.

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Image courtesy of Samsung SDS America.

*AcquireNow* is featured in uniAMS, a commercial product of Samsung SDS America, used for measuring pavement conditions.